

ASSESSMENT OF BRIDGING REQUIREMENTS AND CURRENT BRIDGING  
CAPABILITIES FOR USE OF LEGACY HEAVY FORCES INSIDE THE  
CONTEMPORARY OPERATIONAL ENVIRONMENT

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by

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## ABSTRACT

ASSESSMENT OF BRIDGING REQUIREMENTS AND CURRENT BRIDGING CAPABILITIES FOR USE OF LEGACY HEAVY FORCES INSIDE THE CONTEMPORARY OPERATIONAL ENVIRONMENT, by MAJ Edward J. Repetski, 53 pages.

In the context of increased need to deploy forces globally in support of the war on terror, the complex nature of terrain inside the operational environment demands an analysis of the ability of legacy forces to operate while deployed to diverse regions until replaced by objective force capabilities. The central research question is: Does the Army have the bridging capability to support the legacy, heavy force in the operational environment deployments likely to occur before the counter-attack corps is equipped with objective equipment? Comparative analysis is used. The operational environment is summarized by a numeric analysis of bridging requirements using a set of reasoned parameters. The bridging capability of current force structure is analyzed via the army domains yielding a detailed understanding of what force capabilities are available. A comparative analysis completes the study wherein the demands of the environment are compared to the current capabilities of the force. The answer to the central research question is: No, the Army does not have the bridging capability to support the legacy, heavy force in deployments in the near future. This conclusion is followed by a set of recommendations for action inside the Army domains as well as areas for future study.

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## CHAPTER 1

### INTRODUCTION

#### Historical Perspective

The stories of military campaigns are laced with struggles to cross rivers. Julius Caesar struggled over the Rhine to enter Germany (Toguchi, 1994). Darius lashed boats into a bridge to enter the Peloponnesian Peninsula (Toguchi, 1994). More relevant to this study is the increasing need to cross rivers with wheeled and tracked vehicles as witnessed during the World Wars and in Korea and many other more recent locations like Somalia and Bosnia. Military forces have struggled with the mighty task of moving large, often armored, vehicles over gaps without bridges; other forces in the world certainly recognize that difficulty and will seize the opportunity to increase the challenge of crossing a river by targeting forces attempting a crossing and the equipment that supports them. Modern combat is faster, more dynamic and more lethal than ever; crossing rivers is a difficult and dangerous task that land forces must plan to execute against a thinking enemy.

#### River Crossing with the Legacy Heavy Force

In a brief to a panel on Army Transformation at the annual Association of the United States Army Convention on 17 October 2000, GEN Keane, the Vice Chief Staff of the Army showed a modernization plan that had the Counter-Attack Corps begin fielding Objective Force Equipment in 2017 and finish in 2024 (Keane, 2000). He in fact briefed that objective equipment will not even be completely fielded to the Reserve Components and the Stryker Brigades until 2031. This begs the questions if the Army has



the bridging capability to support the legacy and interim forces in the Contemporary Operational Environment (COE) deployments likely to occur before the objective force is completely fielded.

#### Is River-Crossing an Issue?

In observing simulations-based exercises using legacy heavy forces in the COE, I have noticed that the simulations' conditions for mobility were not realistic and thus were not providing a true stress as a legacy heavy force would encounter on an operational deployment. Among the conditions that were not realistically portrayed were the quality of infrastructure in likely areas of employment and the quantity and types of bridging units available to support a division or corps in an exercise. This is particularly relevant as Division and Corps Maneuver are trained almost exclusively in simulation. Since the disappearance of the RETURN of FORces to GERMANY (REFORGER) exercises, divisional maneuver has become a rare event outside of simulation. The conditions that senior staffs train under in simulation are all the preparation they receive to operate in those positions.

#### What is the Urgency?

The counterattack corps will continue to be a legacy heavy force until fielded with objective force equipment between 2017 and 2024 (Keane, 2000). Until then, that force must be prepared to counter-attack where needed and bridge any gap to assure its own mobility in pursuit of its military objectives. This force is ill-prepared to conduct operations over a poor infrastructure. The force that was designed for the rigors of the General Defense Plan (GDP) fighting an attacking Soviet force in the Fulda and Hof Gaps exists as a mere shadow of its former stature. The legacy equipment from that force still exists in our legacy heavy force but the bridging support for it has been severely

reduced in quantity and shifted predominately to the Reserve Components. The infrastructure of southern Germany was uniquely prepared to support that truly heavy force; but most anywhere else it may be called upon to act the infrastructure will be found lacking. Once, the exercises that happened on the terrain in Germany taught us that rivers would have to be crossed, and we practiced and equipped to do just that. In the COE, a force must be prepared and resourced to retain mobility wherever that force is employed. Beyond the threat faced, this operational environment includes the terrain dimension of the physical environment. That portion of the operational environment is often ignored in the planning and preparation for simulation-based training. I believe that commanders and staffs of force units that face proper mobility constraints during exercises (on the ground and in simulation) will be better prepared to lead that force in an operational deployment. Realistic constraints that properly consider, train and resource mobility requirements for operational action are the best way to prepare a staff to use equipment not specifically designed for the terrain conditions that they will face.

Since the end of the Cold War, the legacy heavy force has avoided this once significant training challenge. The old General Defense Plan (GDP) for West Germany and NATO required U.S. forces to conduct several river-crossing operations. Every REFORGER exercise was laced with bridging operations that were a significant part of the exercise. These exercises forced units to routinely plan, prepare and execute river crossing training events. The winning of the Cold War and the attendant ending of the GDP, the removal of organic float bridging assets from the divisions and Operations Desert Shield and Desert Storm all coincided in 1990 and 1991 to send three messages to the legacy heavy force. The end of the GDP ended the REFORGER Exercise that drove a

great quantity of river crossing training. The removal of the bridge company from the divisional MTO&E meant that no Division could train on river crossing without external support; only four float bridge companies are still on active duty. Operation Desert Storm occurred in one of the few places where M1 tanks could drive for hundreds of miles without needing to cross a bridge. And that operation in Iraq stopped short of the imposing Tigris and Euphrates Rivers.

#### What Are the Parts of This Problem?

The main question then is clearly “Does the Army have the bridging capability to support the legacy, heavy force in COE deployments likely to occur before the counter-attack corps is equipped with objective equipment?” This problem is best divided into three subordinate questions. The first is: “What bridging capacity is required in the COE?” That question requires us to clearly define the bridging challenge of various likely places of employment for legacy forces. The second question is: “What capacity for bridging does the legacy heavy force have?” This question requires us to examine our current capabilities? The third question is: “What is the difference between required and current bridging capacity?” This question asks if the difference is significant. These questions demand an analysis of the current capability against projected requirements.

#### Assumptions

An initial assumption is that all Army units train to prepare for the next Combat Training Center (CTC) rotation. This would fly in the face of training doctrine which requires that CTC rotations are built to support unit Mission Essential Task List (METL). However, the end of the Cold War has made training focus difficult so that units ask CTCs what topics need to be trained and more important perhaps, what the conditions for

training should be. If the CTC conditions do not require a task, then that task will not be trained upon; the unit will commit limited training time and other resources to prepare for the required supporting tasks.

A second assumption is that the Objective Force equipment with its inherent “Assured Mobility” (Department of the Army, 2001) will not be completely fielded to all Echelon above Unit of Employment (UE) units until long after 2030. I assume that Assured Mobility for platforms in the Objective Force will be too expensive or difficult to field to all required platforms in other Army and certainly Coalition Partner units. Thus, a need for legacy mobility support such as bridging is clear at least in coalition to support these units even when legacy force equipment is no longer present in UE organizations. This is strikingly urgent as history shows us; few armies in transition to newer equipment were able to completely field new equipment before having to fight in a war. The Germans of World War II fought with a force that had perhaps completed 10 percent of its transformation to mechanization; they were still conducting logistics operations using horses up until the end of World War II. The American Civil War saw combat units using often archaic equipment despite the knowledge that newer and better equipment was available (Toguchi, 1994). Indeed war is a come-as-you-are party. Any deployment in the next twenty years will probably mandate the use of legacy forces and any large operation in the next fifty years will require the use of non-objective units at least from coalition partners.

#### Related Topics

The scope of this research is to examine the needs of the legacy heavy force to maintain sufficient mobility while deployed in operations in the modern environment.

The general process of this study may be applied to legacy light and to interim forces as well as large support units and coalition partners; those forces will not be examined. The rationale to first examine the legacy heavy force is the use of the counterattack corps as the heavy hammer to swiftly carry a conventional war to a regional hegemon who requires us to execute a ground invasion. This force will be examined against the mobility requirements in the most likely areas of employment currently envisioned. The scope of operational areas will be compared to historical examples, making allowances for current infrastructure, size of divisions and operational areas over which those divisions are required to operate and the capacity of bridges required by the legacy heavy force.

### Key Terms

Before beginning to discuss bridges we must be clear about the technical and doctrinal terms of bridging most relevant to this discussion. The specifics of bridges are deferred to the very technical Field Manual (FM) 3-34.343, *Non-Standard Fixed Bridging* (2002). That FM provides all the technical definitions of bridges and classification as well as acting as the source to make bridge related plans and decisions.

FM 3-34.343 states clearly the preferred order of bridge use. That priority list for bridging use is to first use existing bridges that do not need repair. The Engineer must only classify for military use. The next preferred system is to detour around or bypass. “The assumption is that finding and using detours and bypasses is quicker than reinforcing or repairing existing bridges.” According to FM 3-34.343 bypasses and detours include; alternate routes over undamaged or minimally damaged bridges, routes of railway bridges, a grade crossing around an overpass, fords, ferries, rafts, barges or ice

bridges. The next priority is to repair or reinforce existing bridges. Given the load requirements of the legacy, heavy force, this is often necessary. Once the use, bypass or repair of existing bridges becomes untenable, the force must build bridges for itself.

Self-built bridges come in two categories; tactical and line of communication (LOC). Tactical bridges are used in an assault and are temporary in nature. Furthermore they are limited in quantity and must be rapidly replaced with LOC bridging to return the tactical bridging assets to supporting forward elements. U.S. Army tactical bridging includes; the armored vehicle-launched bridge (AVLB), the medium-girder bridge (MGB) and the Ribbon Bridge. The AVLB is capable of crossing 17-meter gaps using a crew under armor protection (FM 5-34, 2001). The MGB is capable of crossing single spans of 46.2 meters with the addition of a “link-reinforcement system” that can carry an M1 series tank (FM 5-34, 2001). Beyond gaps of 46.2 meters the only tactical bridging in the Army Inventory is the Ribbon Bridge which can carry an M1 series vehicle over any distance provided the water current does not exceed 2.0 meters per second (FM 5-34, 2001). Doctrine further allows for field expedient tactical bridges that could be built from local materials when necessary. While not stated clearly, these would be used only in the absence of a fielded tactical bridge given the uncertainty of capability of field expedients and the time required to construct such bridges. While such systems may work for short gaps, longer and wider gaps are hard to cover by field expediency.

The counterparts to tactical bridges are LOC bridges. LOC bridges are “semipermanent, fixed or float” (FM 3-34.343, 2002) in nature and replace tactical assets until permanent bridges are available. Currently, the U.S. Army uses the Bailey bridge and the Army Facilities Component System’s (AFCS) preengineered bridges and

nonstandard fixed bridge construction. The ingenious and venerable, British designed Bailey bridge system dates back to the Second World War. The Bailey system is very flexible and can be constructed mostly by hand. It is limited to being able to support M1 series vehicles on spans of less than 52 meters (FM 5-34, 2001). The AFCS provides “bills of materials with material cost data, construction drawings, and labor and equipment estimates (LEEs) for 84 bridging facilities” (FM 3-34.343, 2002) through the Theater Construction Management System (TCMS). TCMS is a computer based construction planning, design, management, and reporting system that is used by military engineers for contingency construction activities. Lastly, engineers may use FM 3-34.343 to design with local materials and construct bridges with military or local labor and equipment on LOCs. This is most obviously the least preferred method as design work is slow and requires thorough planning by an isolated engineer, is the most time consuming process and demands assumptions about materials that are difficult to confirm in field environments. Such assumptions include the physical properties of materials such as strength and durability.

#### Scoping the problem

To prevent this study from becoming classified as well as excessively lengthy and circuitous, it is limited to the capacity of the legacy heavy force to cross gaps of more than 46.2 meters over large rivers. The reasons for this include classification problems, complex analysis requirements and a need to make the materiel presentable and compelling to non-Engineers as well as to avoid use of classified sources to keep this study most distributable. A study of global bridging infrastructure without using classified terrain analysis products becomes difficult. Further, while current bridging

capabilities are divided among several different organizations in the U.S. Army force structure, the Float Bridge capability is only present in two, different company size organizations that are readily analyzed. Limiting the study to the Ribbon Bridge allows us to focus the issue on the most challenging of bridging requirements.

#### Summary

The comparison of what is needed against what is available is not a novel concept in recent years, as the Literature Review will clearly show. The process of examination and comparison is useful to clarify problems and formulate solutions. The conclusions and recommendations that follow will demand action to assure the ability of the legacy heavy forces to complete their active life as an important part of the National Military Strategy.



## CHAPTER 2

### LITERATURE REVIEW

A strong body of research has been done on this topic. In general the sources can be divided into three categories: previous graduate work housed in the Combined Arms Research Library (CARL) from the School of Advanced Military Applications (SAMS) and Masters of Military Arts and Science (MMAS); formal studies undertaken by various Army laboratories, contractors and institutions; and Army Field Manuals. The graduate work in CARL from SAMS and MMAS include works by Arnold (1986), Benjamin (1986), Brinkley, (1997), DeLony (1989), Marin (1992), Schroedel (1987), Semonite (1991), Tarbox (1987) and Wells (1990). The formal studies undertaken by Army laboratories, contractors and institutions include Collmeyer (1988) from the War College, the Engineer Studies Center (1992), Parr from the Institute for Advanced Russian and East European Studies (1978), and the Engineer Research and Development Center (ERDC) as reported by Ray and Butler in *The Military Engineer* (2002). Army Field Manuals include Field Manual (FM) 3-0 *Operations* (2001), FM 3-90 *Tactics* (2001), FM 90-13-1 *River Crossing Operations* (1998), FM 5-34 *Engineer Field Data* (2001) and FM 3-34.343 *Non-standard Fixed Bridging* (2002). This work is impressive in aggregate and allows this work to begin at a very high level of resolution.

The CARL collection of master's theses on the subject of bridging operations is detailed, but the work was done in the late 1980's and is based on some similar assumptions that are no longer valid. The assumptions include: the presence of float bridging in the Engineer Structure of legacy, heavy divisions, an Engineer Brigade

organic to the divisions, and that the Divisional Engineer Brigade would resemble a set of battalions similar to the Army of Excellence Divisional Engineer Battalion in robust structure (Arnold, 1985), (Benjamin, 1986), (DeLony, 1989), (Schroedel, 1987), (Semonite, 1991), (Wells, 1990). By way of historic summary, the changes planned for in the Engineer Restructure Initiative (ERI) were not implemented. The Divisional float bridge company was removed from the force structure and most float bridging was moved to the reserve components, in part because ERI happened during the post-Cold War reduction of the Army. The Divisional Engineer Brigade was planned to be almost three times the size of the old Divisional Engineer Battalion, however the drawdown process imposed some austere limitations on the process and in the end the Brigade had to be less than the size of two battalions. A planned force structure of almost 3,000 personnel (Arnold, 1985) became in practice one of about 1300. This Brigade Force was so austere that currently the legacy heavy force is cashiering its Divisional Engineer Brigade headquarters as unnecessary. Relevant to this study, the works done at Fort Leavenworth concerning bridging operations in the late 1980s are similar in that they make the same assumptions about the force having a robust Engineer Brigade in every heavy division and as well as organic float bridging. The impact of these assumptions forces this researcher to have to revisit the conclusions made by those earlier researchers; however their body of work is of such great detail that the process is not overly complicated.

The various studies done by Army laboratories and on contract are similarly dated and have like assumptions. These studies are useful, however, in that some classified the likely areas of deployment and made an effort to quantify the number and quality of

bridges required. This data will prove invaluable for defining the likely operational environ for the legacy heavy force. Furthermore, these studies address specifically the number of vehicles and the operational distances involved. These numbers will necessarily be revisited here as the organizations of legacy heavy divisions in their current limited conversion organization operate over larger distances on fewer platforms.

Army Doctrine is quite helpful to this endeavor. River Crossing Operations are so complex and unique that they have their own field manual, FM 90-13-1 *River Crossing Operations* (1998). This unique source provides detailed accounts of how to cross rivers and defines what a doctrinally sound bridge is. This source is further analyzed in the late 1980's body of work done at Fort Leavenworth which helped refine the details. This manual however, was written shortly after the end of the Cold War and necessarily must be challenged for the details of Soviet doctrine that are present. This means that we must apply the new FM 3-0 *Operations* and FM 3-90 *Tactics* to this older manual to assure continuity.

The composite body of work on bridging with the legacy heavy force allows for a detailed study of the problem of legacy heavy division operations in the early 21st Century. The absence of work in the last decade of change demands revisiting this crucial aspect of tactical mobility. The previous work supports this study; the absence of recent detailed research recently demands this study.

## CHAPTER 3

### RESEARCH METHODOLOGY

#### Focused on the Problem

The question that this research addresses is: “Does the Army have the bridging capability to support the legacy, heavy force in COE deployments likely to occur before the counter-attack corps is equipped with objective equipment?” This is a very important question as described earlier. This topic is quite broad and needs to be broken into more manageable parts. This primary question can really be addressed from three points-of-view: the requirements question: “What bridging capacity is required in the COE?”; the current capacity question: “For what capacity for bridging is the legacy heavy force equipped and prepared?”; and the comparison of the two: “What is the difference between required and current capacity?” Each of these questions is further dissected below. As previously mentioned this will all be done focused on the use of float, tactical bridging to cross large rivers.

#### The Question of Requirements

The question of requirements is really asking: what are the needs for bridging in the current, legacy, heavy force structure? That question evokes further questions including: where that force will be needed, what size area legacy formations will be asked to operate in, doctrinally how many bridges and of what character will be required and how many bridges will be provided by *in situ* infrastructure. I will address how to answer each of these questions.

The first question step is to define the operational environment where the legacy, heavy force needs to deploy. For that information, I will turn to national planning guidance. I will examine the National Security Strategy (2002) and the National Military Strategy (2002) and address those regions of the world where military action is predicted and for which the Army is tasked to provide forces.

The second step is to define the area over which a division or corps would be tasked to operate. For this answer, I can not guess better than the Army leadership and will turn to the various exercises designed by the Army leadership to help us understand the COE. As part of the COE, divisions and corps will be expected to operate over larger areas, and those exercise sought to define the area. I will use the Army Transformation Wargames and the Division Capstone Exercise (DCX) scenarios to establish the area in of which units will be expected to operate.

The third part of defining the requirements is to compare the environment that exists in potential deployment locations in terms of number of bridges and their capacity required per unit area to support a unit. Doctrinally, I will use FM 90-13-1, *River Crossing Operations* (2001), to define how many bridges are required by various elements. This requirement will be combined with a definition of the unit area and the terrain to define how many total bridges will be required for a force to operate.

The fourth question is: "What kinds of bridges exist *in situ*?" The U.S. Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC) is attempting to solve both of these questions but as I will be focused on wide rivers I will assume that the in situ bridges will be destroyed by a regional hegemon as part of a strategy of exclusion as expressed in FM 7-100 *Opposing Force Doctrinal Framework*

*and Strategy* (2002). Given this scenario we assume that use no bridges over large rivers will remain *in situ*.

At the end of this process, I will show a table that tabulates by region the wide river crossing dilemmas that deployed forces will face as part of the environ. The table will be based on the important regions, the operational areas for divisions and corps, and the length of wide river that a force would have to use.

### The Question of Capabilities

The question of capabilities is really asking: “What capacity for bridging is in the current legacy, heavy force structure?” To define capacity is difficult without subdividing the question. I have chosen to use the standard of analysis by function of DOTMLPF; Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facility functions. Of course, Doctrine addresses requirements and will be handled first the balance of functions aid in defining capability. I will analyze those six categories to define current capacity. Of the six, Training and Leadership and Education and Personnel are mostly qualitative and best addressed from that perspective while Organizations, Materiel and Facilities are more quantitative.

I will address Training and Leadership and Education and Soldier functions via Battle Command Training Program (BCTP) trends analysis publications to show current trends inside the legacy heavy force in terms of leader preparation and unit training. The purpose of this analysis is to look for trends in terms of combined arms preparation for bridging and to see if any of those trends are relevant to the issue at hand.

Organizations available will be confirmed through the U.S. Army Engineer School (USAES) and will be analyzed by component (Active, Reserve, National Guard)

and by level of preparedness (such as Force Support Package levels of Reserve Component units). The organizations will be tabulated by component and availability.

Materiel available to United States Army units is quickly summarized by using doctrinal manuals. Using these manuals, I will define the capacity of current Army equipment. I will summarize this data in terms of quantity and quality of bridges that unit sets of this equipment can provide operationally.

Facilities will be addressed based on my personal visits to all four of the Army's Combat Training Centers (CTCs). I will address the ability of these facilities to support training.

At the end of the analysis, a summary will be provided that articulates the current capacity of the Army to conduct bridging operations in support of Army deployments. This summary will address the quantitative aspects of organizations and materiel available to indicate the capability currently available.

#### The Comparison

The comparison expresses the quantitative and qualitative differences between the necessary and current capacities to bridge. This summary will suggest some recommendations to address any issues. In total the comparison should show us if the Legacy Heavy Force has the capacity to assure mobility in the Contemporary Operational Environment.

## CHAPTER 4

### ANALYSIS

#### First: Defining the Constraints of the Environment

To define the operational environment that will be faced by the legacy heavy force requires a degree of conjecture. Making the best informed estimate of the environment and the demands that will be placed on the legacy force for the next twenty years is not trivial. The environment requires an estimate of where the force is likely to be employed, over what expanse an area will the legacy heavy force need to operate, what bridging capacity that force will require over that terrain and how much of that requirement is likely to be provided by the infrastructure already in place. Each of these is addressed in this section.

Where will forces need to deploy? In the National Security Strategy (NSS), President Bush (2002) is not precise on where force is likely to be deployed but does not waver from stating that deployment will be needed to achieve National Security Goals. The NSS clearly states that “To defeat this threat (terrorism) we must make use of every tool in our arsenal--military power, better homeland defenses, law enforcement, intelligence, and vigorous efforts to cut off terrorist financing.” The Strategy goes on to state that “the war against terrorists of global reach is a global enterprise of uncertain duration. America will help nations that need our assistance in combating terror. And America will hold to account nations that are compromised by terror, including those who harbor terrorists.” The urgency is clear when the strategy states, “As a matter of common sense and self-defense, America will act against such emerging threats before



they are fully formed.” And the active nature is confirmed by the statement that “In the new world we have entered, the only path to peace and security is the path of action.” In total the document very clearly requires a military that can deploy on short notice and globally both to support friendly nations in the global war on terrorism and to oppose those that provide sanctuary to terrorists. The tone is clearly global, active and time sensitive.

The National Security Strategy continues in detail to describe the requirements of the war on terrorism. In the statement of strategy concerning the war on terrorism the NSS (2002) states:

We will disrupt and destroy terrorist organizations by: direct and continuous action using all the elements of national and international power. Our immediate focus will be those terrorist organizations of global reach and any terrorist or state sponsor of terrorism which attempts to gain or use weapons of mass destruction (WMD) or their precursors; defending the United States, the American people, and our interests at home and abroad by identifying and destroying the threat before it reaches our borders. While the United States will constantly strive to enlist the support of the international community, we will not hesitate to act alone, if necessary, to exercise our right of self defense by acting preemptively against such terrorists, to prevent them from doing harm against our people and our country; and denying further sponsorship, support, and sanctuary to terrorists by convincing or compelling states to accept their sovereign responsibilities.

This statement clearly requires the Army to prepare to deploy to various climes where terrorists may find sanctuary or support and deploy to conduct the full range of military operations. The mandate to continue transformation is stated clearly in requiring that we “continue to transform our military forces to ensure our ability to conduct rapid and precise operations to achieve decisive results.” That statement does not allow for the need to conduct rapid and precise operations to be deferred for twenty years until the new

equipment is available. The mandate to execute with current systems is clear with the requirement in the NSS for our forces to “decisively defeat any adversary if deterrence fails.” (2002)

The Joint Chiefs of Staff draft of a new National Military Strategy (2002) gives no more specifics on location but reinforces a need to be capable on short notice to act decisively globally. Note the tone from the introduction to the National Military Strategy (2002) when the following is stated:

Military forces, by their presence and activities, serve to assure friends and allies of US resolve and ability to fulfill its security commitments. They may also dissuade adversaries from pursuing courses of action or developing dangerous capabilities that threaten global security, and they provide the President with a wide range of options to deter aggression and coercion. If dissuasion and deterrence fail, military forces must be prepared to defeat any adversary at the time, place, and in the manner of our choosing. Together, the defense objectives and policy goals necessitate a wide range of military requirements to meet the current and future challenges of a dangerous and uncertain security environment. Achieving these goals and objectives requires a capabilities-based approach to defense planning. Such an approach focuses less on who an adversary may be or where a conflict might occur and more on the capabilities that adversaries may employ.

The tone clearly requires that the Army be prepared to deploy and act decisively and globally.

Having shown the global requirement, perhaps the best way to predict the requirements for future deployments is to examine recent and current deployments. I have chosen to examine the following areas of the globe: Iraq, the Korean Peninsula, Honduras, Columbia, Somalia, Yemen, and Afghanistan. Iraq is an obvious topic as the opponent during the 1991 Operations Desert Shield and Desert Storm and likely opponent for ground action during 2003 by a U.S. led coalition. It is a nation with a large

armored force and includes the formidable valley of the twin rivers; the Tigris and Euphrates and the accompanying array of canals and tributaries. The Korean Peninsula has been an area of continuous United States military presence since the Korean War in the early 1950s. That Peninsula is the last place of active containment of communist expansion opposing an increasingly dangerous and volatile threat. The Korean Peninsula has rugged terrain and major rivers running through and across steep mountains along with large urban areas. The United States continues to operate JTF B in Honduras. Columbia is the site of ongoing U.S. support to a government combating a drug-trafficking, terrorist-affiliated organized crime wave. Combined these last two countries typify areas in South and Central America where the United States has historically acted as the keeper of the peace. Sudan, the site of ongoing UN missions, serves as an example of the terrain in the volatile Horn of Africa. Afghanistan, site of Operation Enduring Freedom serves as an example of the terrain in central Asia. The Balkans area, which has been the site of ongoing operations since the collapse of the former Yugoslavia, serves as another example of complex terrain in another region of ongoing turmoil. This terrain set enables a discussion of the general nature of the terrain challenge to legacy forces deployed throughout the globe. A summary of these areas is shown later in a table after discussing deployment areas of U.S. forces and infrastructure capability later.

What constitutes the area of employment for a U.S. Division? The second step is to define the area over which a division would be tasked to operate. The last six years has seen a number of Army level experiments. In the Division Capstone Exercise in 1997, I observed a legacy heavy force occupy an area of 160 kilometers by 80 kilometers or a total area of 12,800 square kilometers. In the Army Transformation Wargame 2000

(Pirnie et al, 2001), five divisions occupied about a third of Iraq or about 130,000 square kilometers. Each Division occupied an area of about 20,000 square kilometers. To scale the bridging needs of future deployments we will scale the areas of each region by the 12,800 square kilometers that were used during the DCX II. This number is useful because it is a conservative estimate of the future for such organizations on what is predicted to be a less linear and dispersed battlespace.

How much bridging will the force require? A detailed discussion of doctrine follows in the next section but the conclusion from that is if a unit is cut by a large river the higher headquarters will want a minimum of two bridges to support each subunit. If a division has one brigade across a river, two bridges will be needed to assure continuous support and allow for reinforcements as well as to guard against an enemy attack or accidental loss of a bridge allowing a force to be isolated. If a division has two brigades across a river, four bridges will be necessary. Bridging organizations and equipment capability will be discussed later but a company sized bridge set is capable of emplacing one 215-meter bridge or two 100-meter bridges. Commercial waterways are routinely close to a hundred meters in width. Further, the company that emplaces float bridging must provide on going support to the bridges by repairing and replacing components and separating bridges to allow for flotsam to by-pass the bridge. So we conclude that a company could support one or two significant bridge sites given the dispersion of sites and likely width of rivers.

Will local infrastructure be available to support legacy forces? The last part of defining the requirements is to address the available local infrastructure. As we have limited this discussion to only wide rivers, the best assumption is that such bridges will

not exist. The new FM 7-100 *Opposing Force Doctrinal Framework and Strategy* (2002) clearly indicates that an enemy will destroy these critical pieces of infrastructure to attack the heavy and logistics intensive natures of our forces. This means that bridges over large or navigable rivers will have to be brought into the theater with forces for temporary bridging purposes and replaced with permanent bridges over time.

How does the total environment look? In summary, table 1 on the next page articulates the demand for bridging that will be faced by heavy forces in deployments. The table was created by using numbers from the CIA's *World Factbook* (1995). The left hand column lists as areas of interest those locations that were listed as relevant earlier. Note that the statistics for the Korean Peninsula are the sum of the numbers listed for North and South Korea and that those for the Former Yugoslavia are those for the several nations that emerged from Yugoslavia. The second column and third column list the areas in square kilometers and navigable waterways in kilometers respectively. In column four, the areas in column two are divided by the area of 12,800 square kilometers which above is given as a possible area of operations of a Division permitting us to analyze these areas as representing a number of Divisional Equivalent Areas. Lastly, assuming that wide rivers are evenly distributed over the country the rivers are distributed by dividing the length of navigable rivers by the number of Divisions to allow us to address the problem from the perspective of Divisions. This very crude method of quantifying the problem allows us to demonstrate that Divisions will likely need to cross rivers inside their Area of Responsibility.

Table 1. A comparison of Density of Wide Rivers in notional Division AOs(CIA, 1995; CIA, 2000)

Areas of Interest	Area	Wide Rivers	Divisions	River Length per Division
	square km	km		km
Afghanistan	647,500	1,200	51	24
Columbia	1,038,700	14,300	81	176
Former Yugoslavia	234,535	1,372	18	75
Honduras	111,890	465	9	53
Iraq	432,162	1,015	34	30
Korean Peninsula	218,600	3,862	17	226
Sudan	2,376,000	5,310	186	29

This data shows us that the areas where we have recently operated or are likely to operate again have wide rivers with which forces on the ground must contend. At the top end of the spectrum are the Korean Peninsula and Columbia where 176 to 226 kilometers of river will be in the area of operations (AO) of a Division in that environment. At the low end of the spectrum is Afghanistan and Korea with 24 and 30 kilometers of river in a Division's AO. A limitation of this data is that Rivers are not evenly distributed around countries. The area in southern Iraq where Operations Desert Shield and Desert Storm occurred is away from any rivers. The area around Baghdad is in a valley with both the Tigris and Euphrates Rivers. Thus, the assumption that rivers are evenly distributed is a poor generalization. However, rivers are an important source of water and transportation as well as a source of fertile growing areas and are thus areas of concentrated populations and urban areas, important resources and seats of power. So these numbers could vary widely depending on where in a given region a force is operating but the civil dimension of most operations suggests that we will be rather closer to rivers than farther from them. Thus a Division will often have at least a single subordinate element on the other side of

a wide river that will almost certainly need to be bridged. Further, some areas like Korea and Columbia (and by extension, Asia and South America) will have great demands for bridging inside divisional AOs. By observation, commercially capable waterways are usually 100 meters wide and can be several hundred meters wide.

Three conclusions can be made about the environment from this analysis. First, legacy forces spread over extended and less linear battlespace will often be split by wide rivers or bounded by considerable lengths of wide rivers. Secondly, thinking enemy forces will recognize the vulnerability of bridges so we must plan to bring and build bridges for deployed forces.

#### Secondly: Define the Capabilities of the Current Force

Defining capabilities requires answering the following: “What capacity for bridging is in the current legacy force structure?” by dividing that question into the subordinate parts using the DOTMLPF; Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facility functions. The functions are addressed in a logical order applied to this issue. Of course, Doctrine addresses requirements and thus in part addresses what kind of capacity is required vice what capability exists and, thus, must be addressed first. Organization and Materiel will be addressed next as the equipment is resident in two organizations and thus the Materiel is linked to specific organizations and these are easily addressed jointly. Training, Leadership and Education, especially given the higher-echelon requirement of bridging operations will be examined later and are naturally conjoined. The domain of Personnel is an issue that will be addressed as an extension of the discussion on Training and Leadership. Lastly, Facilities for training will be discussed as an important part of this issue. In summary, the Army

functional domains will allow us to examine the capability of the total force to meet the challenge of assault float bridging and give a strong image of capability.

Doctrine Doctrinal requirements for bridging capacity are found in the Army's Doctrine. FM 3-0 *Operations* (2001) does not directly cover bridges but covers broad concepts that demand a focus on bridging. FM 3-0 talks about Operational Reach, Lines of Communications and the connection between the two. First FM 3-0 discusses the need for Army forces to dominate land operations. To dominate land operations the Army must "close with and destroy the enemy." This is accomplished through maneuver and precision direct and indirect fires. Maneuver as an Element of Combat Power (FM 3-0, 2000) is the "employment of forces, through movement combined with fire or fire potential to achieve a position of advantage with respect to the enemy to accomplish the mission." The need for movement at both tactical and operational levels implies the movement over obstacles such as gaps and thus to bridge. The concept of Operational Reach implies the requirement to support Tactical Formations away from their operating bases and demands support to both their ability to maneuver and to their supply. While Lines of Communications include Air, Land or Sea the needs of the legacy force demand supplies that exceed the capability of airlift and demand ground LOCs. Combat Service Support (CSS) "factors influence operational reach and sustainability includes distribution networks" including bridges. Thus bridging must be available to allow the movement that is demanded by operational and tactical maneuver as a component of the combat power of tactical formations and to allow the operational reach via ground LOC support demanded by the legacy, heavy force.



FM 3-90 *Tactics* (2001) discussion reinforces FM 3-0 assertions about the need for mobility among tactical formations and the need for ground LOCs. Relevant is what it says about mobility. “Mobility is key. Its major focus is to enable friendly forces to maneuver freely on the battlefield.” FM 3-90 goes on to say:

Maintaining the momentum of an offensive operation requires the force to quickly pass through obstacles as it encounters them. This translates to a deliberate effort to capture bridges and other enemy reserved obstacles intact. Using air assault and airborne forces is an effective technique to accomplish this goal.

And;

Rivers remain major obstacles despite advances in high-mobility weapon systems and extensive aviation support. River crossings are among the most critical, complex, and vulnerable combined arms operations. Rivers are crossed in-stride as a continuation of the attack whenever possible. The size of the river, as well as the enemy and friendly situations, will dictate the specific tactics, techniques, and procedures used in conducting the crossing. Corps engineer brigades contain the majority of tactical bridging assets.

The manual indicates that River crossings are important tactical enabling operations that are so complex and technical that they need a separate manual to cover them. FM 3-90 does address the importance of LOCs and admits that group LOCs would be necessary for a legacy group force they do not address specific bridging needs. The requirement to have redundancy in capability is implied throughout the CSS discussion.

FM 3-97.13, *River-Crossing Operations* (1998) states as a rule of thumb that each lead brigade requires two bridges. During an attack a division would require two bridges per brigade in the lead. While this is clearly stated as a rule of thumb and not as a doctrinal mandate, the risks of a single bridge for a brigade are obvious. Tactical bridging does not allow for two-way traffic impeding movement on a bridge and a single bridge is

easily interdicted by natural and enemy forces that would sever ground lines of communications (LOC). Two-way traffic given the narrow roadway of tactical bridges further demands multiple crossing sites.

In summary, doctrine requires bridging as a necessary part of enabling maneuver for legacy tactical formations as well as supporting ground LOCs for the sustainment of those formations as part of operational reach. Legacy, heavy organizations require tracked, MLC seventy bridges to allow the maneuver of the M1 series of tanks. The LOCs supporting legacy heavy forces need tracked MLC seventy bridges for M1 tanks or wheeled MLC 105 bridges for M1 capable transport trucks (Foss and Gander, 1999). Dominate maneuver demands in-stride crossings to maintain initiative which requires the ability to plan, prepare and execute crossings.

Organizations and Materiel Float bridging capability is resident in only two different organizations in the United States Army; the Multi-Role Bridge Company (MRBC) and the Assault Float Bridge Company. The newer, MRBC is an evolution of the Assault Float Bridge Company created by combining an Assault Float Bridge Company with the additional equipment to allow it to double as a Medium Girder Bridge Company when not occupied with building or using Float Bridging. The float bridge capability of both of these organizations are identical; to build 215 meters of MLC seventy Float Bridge on water flowing at 2 meters per second or less (Foss and Gander, 1999). The Total Army has two Assault Float Bridge Companies; one Active Army Company, the 50th located in Korea and attached to the 2nd Infantry Division, the other is the 1041st Engineer Company of the Wyoming Army National Guard. The vast majority of the Total Army Float Bridge capabilities are in the MRBCs. Three MRBC are

in the active component meaning that ten of the fourteen companies capable of constructing float bridges are in the reserve components. To put this in terms of meters of bridging, the Army has an Active Duty capability to construct 860 meters of float bridging with the capability to construct an additional 2,150 meters in the Army Reserve and National Guard for a total of 3,010 meters of Float Bridging.

The materiel for bridging consists of the Ribbon Bridge system and its follow-on upgrade the Improved Ribbon Bridge. Both systems have similar capability. The system consists of a series of bays, interior and end. All bays unfold when dropped into water from a truck or helicopter. The interior bays can mate at both ends with other bays; end bays can mate with another bay at one end and have a ramp at the other to accommodate vehicular traffic. The bays are moved and manipulated in the water by special boats that are resident in the bridging companies. The bays in the water can be quickly joined by a series of links that a soldier can quickly manipulate once two bays are brought together by boats. A set of bays can be used either to build rafts that can be powered by the bridge boats. While an effective means to move a few vehicles during the early stages of an assault, rafts are very inefficient substitutes for bridges.

Training, Leadership and Education and Personnel Training, Leadership, Education and Personnel are linked because of the small number of units capable of using Float Bridging and the doctrinal need for Divisions to execute deliberate crossings as stated in FM 3-97.13 *River Crossing Operations* (1998). Training is a significant issue that includes the current framework for training on float bridging operations, where such training is executed, how often and to what detail. These operations are normally executed at division level or higher. The leader development piece includes to what

degree such headquarters are able to execute this difficult task. Personnel who build bridges are MOS 12C Bridge Crew. Engineer Officers are the staff experts for planning bridging operations. However any soldiers that must cross a bridge are part of the operation and can use training at some level.

Training on bridging is not done normally below Division level. Based on observations of all four CTCs; JRTC, NTC, CMTC and BCTP the only CTC where bridging can be trained is in the simulation environment of BCTP. Obviously, simulation training may improve the ability of the staff to plan at the trained level but lower levels do not receive the experience of doing the task. A Recent *Engineer* magazine article discusses simulation training (Kurka and Dosa, 2000) and a *Killeen Daily Herald* article expands on actual execution (Dwyer, 2002). The simulation training experience allowed the staff to plan and execute crossing operations and deal with some problems associated with actual crossing. Actual training included variables that are not involved with simulations such as equipment problems, traffic flow at the bridge, vehicle operators unfamiliar and uncomfortable with operating on float bridging just to name a few.

Even given the somewhat sterile environment of simulation, LTC Bickel, the senior Engineer in BCTP at the time of his article in *Engineer Magazine* (2001), writes “Staffs do not identify, and units do not set, the conditions to conduct river-crossing operations. . . Commanders and primary staff officers tend to view river crossings as an engineer operation instead of as a complex combined arms operation. . . Units assign river-crossing operations to subordinate units and do not provide the required support.” The tone of these observations suggest that staffs and commanders are not familiar nor intellectually prepared to plan, prepare and execute river-crossing operations and tend to

delegate the task to subordinates who are similarly ill-prepared. The assumption is, based on these comments, that division leaders are not well-prepared to conduct bridging operations and need further training.

Here is how this is tied to Leadership and Education. If a given division or staff does not do well at planning and executing a task than that unit has a training deficiency. If the corporate whole of the Army is poor at a task, as LTC Bickel suggests, than the Army has a Leadership and Education deficiency. As discussed earlier, the Army was caused by a series of events to move away from training on bridging operations and a great deal of corporate experience was lost. The Education system as well as the education provided “on-the-job” included very little bridging training. Whatever the cause leaders are often unskilled at the intricacies of these complex operations.

Personnel issues are tied to this only to the extent that they are tied to the training and education of soldiers and leaders. As promotion and assignments move personnel around the Army, individual exposure to the similar problems in one job are rare. The current turbulence of personnel indicates that repetitive training of complex events is required to constantly integrate new personnel into complex processes. The Article by Dwyer (2002) would indicate that such training is not conducted very often and thus personnel turbulence prevents organizations from achieving higher proficiency.

Facilities The Army trains at the CTCs. As the Army mission has become less tied to specific terrain, the Army has become increasingly focused on preparing for unit training rotations to the CTCs. The three dirt CTCs, by my observation, do not include even minor water-crossing obstacles. The reasons may include a desire to prevent training from being restrained by infrastructure, safety or environmental issues. However,

units at Brigade and below do not train on crossing water obstacles at home station because they are not expected to execute such missions at the CTCs. Only in BCTP simulation are wide river obstacles faced as training objectives. In the Dwyer Article (2002), units training at Fort Hood were able to do a limited bridging exercise outside of simulation and required a large portion of the training area to do so. Given that Fort Hood is one of the largest training areas in the Army, the difficulty in executing bridging training there only highlights the problems in doing realistic training elsewhere.

DOTMLPF Inside the Army domains, the capability for bridging can be summarized as the Army has good material and solid doctrine. The organizations available are capable of providing bridging support to a limited number of divisions but a large scale deployment in an area with significant large rivers would quickly tax the total forces capability to support. An analysis of training to include leadership, education and personnel suggest that river-crossing training is not done frequently enough in unit or individual training to provide the necessary sets of individual or leader skills to execute these tasks routinely. Lastly, the physical facilities inside the Army are designed to avoid bridging operations so that they do not require the training and leader development that this important task requires.

#### The Comparison

The environment demands that any deployed division will probably have to contend with a large river without infrastructure bridges either inside its boundaries, across its LOCs or both. The number of bridges required would be most probably two to four. The length of those bridges could be from a little under a hundred meters to over a

thousand meters. Thus a deployed division would require at least one and perhaps four or more bridge companies to maintain open LOCs and to support dynamic maneuver.

The capability of the Army to support bridging operations is perhaps limited by insufficient Training, Leadership Education and Personnel experiences as a result of, in part, facility inadequacy. But the Army Doctrine and Materiel are able to support the needs of the Army through special Organizations. The Army has enough bridging to support 3010 meters of bridging. An essential question when planning for any contingency is to define the bridging needs of a deployed force. The evidence gathered to this point is that two to four bridge companies are required to support the operations of legacy heavy forces. Given that the Army has six active and eight National Guard legacy, heavy divisions for a total of fourteen divisions against only fourteen float bridge capable companies the ability of the Army to mobilize entirely is suspect. Legacy light forces still need float bridging on LOCs. Assuming that Light Divisions require two float Bridge companies and heavy forces three companies per division, the total bridging capacity of the Army could support a total of four to six divisions in a deployment to an area that is moderately bridging intensive without relying on allies, captured bridges or allocation of bridges successively to units as they are committed.

The conclusion is that any large scale contingency that requires operations over wide rivers will need to manage bridging assets and operations tightly at the highest levels. Such assets are easily identifiable as large bridge trucks with boats and bays are easy to find. The boats and bays are very vulnerable as they are lightly armored and must be relatively air-tight to float. The quantity available will be critical and intensely managed. These three characteristics; identifiable, vulnerable and critical will make them

quickly become top targets for a thinking enemy. The need for redundancy of these assets is increased by the ability of an enemy to find and attack them as critical enablers to two U.S. Army strengths; heavy firepower and dominate logistics.



## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

As a summary of the preceding analysis, the following conclusions are drawn and related recommendations are made. The conclusions are preliminary given the unclassified nature of this study but give impetus for a more detailed if classified project. The associated recommendations regard both the expansion of this study as well as trying to give focus to the combined effort of many professionals on reducing the impact of the potential shortfalls quickly and systemically.

#### Conclusions

The conclusions are divided into three parts: those that concern the operational environment, those that concern current capability and those that are drawn from the comparison of the first two. These conclusions offer a clear and compelling case for action from the lowest to highest levels of the Army.

The following conclusions are drawn about the Operational Environment: the need exists to deploy legacy forces to uncertain locals around the globe, the terrain challenge is diverse, the dispersed nature of future war suggests that Divisions will need to cross rivers often in or adjacent to their areas of operation. The global security environment is uncertain and demands active American military participation, as is well articulated in the current National Security and Military Strategies. The environment will require legacy forces to be capable of effective deployment globally to cover the entire spectrum of missions in any type of terrain. The global war on terror has forces currently deployed in a variety of places clearly validating a conclusion that forces must execute all

tasks globally and on any type of terrain. The global terrain challenge is hard to articulate fully in any unclassified study but the simple numeric analysis in the previous chapter suggests that almost any deployed legacy division will need to cross large water obstacles. As small drainage structures are more common than large ones, we can further extrapolate that for every large river more than one small drainage structure must be crossed. The COE suggests that divisions must operate with greater dispersion and in less linear fashion. The increase in the area of operations carries the implied task of dealing with more terrain challenges in each deployed unit than was previously normal to conduct maneuver and to maintain ground lines of communications.

The Operational Environment is one of increased uncertainty as to the location of any enemy. The era of doctrinally using limited float bridging for maneuver and supporting Engineers following and replacing tactical float bridging with more permanent bridging is challenged by a less linear battlefield. Dominant Maneuver may be required in less linear ways and ground lines of communications may be “on the front.” Thus a division will need to maneuver throughout the extended battlespace and will be vulnerable to attacks upon lines of communications. Both these requirements suggest a need to increase float bridging assets to support a division both to allow the flexibility for extended divisions to cross large water obstacles inside assigned areas of operation and to rapidly open or reopen lines of communication until more permanent bridges can be built or rebuilt and defended. The numbers suggest that a division deployed, even in the driest terrain will need 600 to 1,200 meters of float bridging capacity.

In summary, global deployability in large and dispersed battlespace demands that units so deployed be well resourced with float bridging to deal with diverse terrain, poor

or depleted infrastructure and less linear battlespaces. The capacity required, while varied by terrain suggests that minimally 600 to 1,200 meters of float bridge will be required for any deployed division.

### The Capability of the Legacy Force

Conclusions about the capability of the legacy force are quickly summarized by the DOTMLPF functional domains. Each domain offers some important conclusions. By examining each, both conclusions and recommended solutions are exposed. Doctrine, the first domain, once examined, appears to be accurate, reasonable and useful. The balance of domains offer more detailed results.

As the only organizations that support float bridging are the Assault Float Bridge Company and the Multi-Role Bridge Company and as both operate with the Ribbon Bridge the linkage between Organization and Equipment allows both to be addressed together. The equipment is excellent for the task. It is portable, maintainable, and reliable. The equipment is easy to use and an effective example of the most common military solution to the problems of crossing water obstacles (Foss and Gander, 1999). The limitations of the equipment are that it is degraded when the water flow rate is above two meters per second and requires very specifically chosen or laboriously prepared embankments to support bridging operations. The Organizations appear adequate to erecting bridges but are inadequate to planning, preparing and controlling crossing operations. At a minimum the ability to support division planning and the need to supervise the execution and control of crossings requires additional headquarters on top of the companies. Currently the Army has fourteen companies capable of float bridging for a total of 3,010 meters of float bridging.

Training, Leadership and Education and Personnel are three linked domains. The equipment is easy to operate but the placement of most bridging in the Reserve Components away from Active Component divisions combines with river crossing being a division and higher level task means that most training is done in simulation. A simulation training environment means that most soldiers and their leaders have almost no physical exposure to bridging outside the technically specific Engineer community. Most leaders and soldiers are neither exposed to nor have they trained with tactical bridging. Most that have any exposure only have it through simulation. Facilities provide a picture of the pervasiveness of this problem. Most brigade and smaller units train focused on the next ground CTC rotation. The ground CTCs have no bridging requirements and are built to avoid bridging as a topic. Therefore lower tactical echelons have almost no exposure to the practical matters of bridging.

The ability of the Army to conduct float bridging operations consists of fourteen companies with 215 meters of bridge capability per company for a total of 3,010 meters of float bridge. Ten of those fourteen are in the Reserve Components. The ability of the force to use the bridges is limited to training happening almost exclusively in simulation and among Engineer units. Most ground maneuver forces have only crossed float bridges in simulations.

#### Comparison of Environment and Capability

Comparison of capability and environment suggest that the six, Active Component, legacy, heavy divisions would require a minimum of six to twelve hundred meters of bridging and the Army has only enough to minimally support three to five divisions. Further, no additional support exists for the four, legacy, light divisions, the

eight National Guard divisions or the various separate combat brigades. Ten of the fourteen companies are in the Reserve Component and require advance notice to mobilize and may need post-mobilization training. Thus the needs of perhaps as few as two divisions in extreme terrain are met by the current capability and then only after a total mobilization of float bridging capability.

Clearly, a thinking enemy will see and try to exploit this short-fall. Once a regional hegemon senses that he must destroy his own infrastructure to continue to exist, he will target float bridging to reinforce water obstacles. Given the shortfall and the relative ease with which tactical bridge components can be found and targeted on the modern battlefield, an enemy may quickly attempt to capitalize on the paucity of bridging capability. This exposure demands a redundancy of bridging capability that currently does not exist.

#### Recommendations

Having identified in some detail a shortcoming of the capability of the legacy force to support float bridging, I will make two sets of recommendations. The first are a set of recommendations for a solution to the problem that can be implemented at various levels and a set of recommendations for further research.

A recommendation is to drive the solution through units training at the ground CTCs. As CTCs missions drive training requirements, multiple units trying to add some crossing elements to training can impact larger decisions across the Army. The first areas are the DOTMLPF domain areas of Training, Leader Development and Education, Personnel and Facilities. Leaders at every level can impact these areas by including and conducting float bridging into the training plan. By including bridging in training, leaders

and other personnel become familiar with the very practical if mundane issues of bridging such as how to move vehicles on bridges and what is the sensation of moving on a float bridge. Units on installations that have bridging areas can use these facilities to broaden training and drive leaders to face challenges that will prepare them to solve bridging problems in actual deployments. If units include bridging in home station training outside of simulation, brigades and smaller units will become proficient at bridging skills. The need to include such tasks at CTCs will become evident and CTCs will incorporate such training at their locations.

The doctrine domain appears to not need any revision other than to address how to cope with bridging demands on a less-linear battlespace. While the Materiel appears completely adequate to the task, the organization does not currently support training or deployment. With only four active component float bridge companies, most active component units cannot execute float bridge training without coordinating for reserve component units to support their training. While such events are positive they are inherently difficult to arrange. If float bridging becomes a priority, then such coordination will be executed. Moreover, once the volume of required bridging becomes apparent the force structure of bridging will be expanded to provide sufficient support assuring the mobility of the legacy force until replaced.

#### Further Study

The recommendation for further study is to apply the mechanics of this study in classified, numerical detail to a variety of terrain sets to identify the scope of total required bridging needs for the legacy and interim forces. The mechanics of this study can be applied, with sufficient data, to analyze in greater rigor the bridging needs in the

most likely and most recent areas where legacy forces might operate. Classified numbers about the quality of infrastructure can remove some of the crudeness of the model herein used. The summary of this information should be expanded to include the legacy, light divisions to allow for complete summation of requirements. The mobility problem of wide, water obstacles must be expanded to all wet and dry gaps over which forces will require bridges. Such expansion may require an analysis of the capability of many more organizations and various types of equipment but will provide a more holistic vision of the capability of the force. Such a study must include the needs of the Interim Force and perhaps legacy elements that may linger once the Objective Force is fielded. Only by studying the entire picture can recommendations to meet the needs for training and future procurement and organization be adequately drawn.

#### Conclusion

Meeting the challenges of the ever evolving and elusive Operational Environment demands a continuous and open process that defines probable challenges against current capabilities. Such a process demands the intellectual engagement of all leaders to identify new challenges while clearly understanding current capability. To that end, the engagement of all leaders in a constant, informed analysis of the current environment and capability allows for solutions to be found and resourced at the lowest possible level and disseminated to the wider force. While this paper attempts to define the shortage of float bridging and the related training inside legacy, heavy divisions, the intent was to clearly define a method for all elements of the Army to analyze ever changing environmental requirements against capabilities and to find solutions to shortfalls that are discovered throughout the Army as it honestly adds those environmental challenges to training.

Postscript -- As this study is being concluded an International Coalition has destroyed the Hussein Regime in Iraq. Based on coverage of the campaign, it is my opinion that the need to quickly seize bridges over the Tigris and Euphrates and the need to protect dams that might allow the regime to flood the river valleys drove the maneuver of the fight. Currently, neither a summary of bridging needs nor an indication of the amount of bridges deployed is available. However, the scheme of maneuver that can be deduced from media coverage indicates that the Attack by V Corps and II Marine Expeditionary Force were often focused on seizing bridges intact to maintain momentum. Iraq in general has a lesser density of rivers but the area of Iraq's valley of the twin rivers was an area of intense focus. The lessons learned in this operation would make an interesting addendum to this body of work.



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